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THE SAN MATEO STUDY OF THE NUTRITIONAL STATUS OF THE AGING *

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The relationship of food habits and consequent nutritional status to health, longevity and maintenance of physical and mental powers has been demonstrated by various clinical and experimental studies. Such studies have usually considered only a limited number of subjects, have been confined to institutional cases or have not coordinated dietary records with biochemical and physical findings on the subjects.

The study undertaken recently was an attempt to coordinate all these factors in the examination of a large number of supposedly healthy men and women over 50 years of age, for the most part living in their own homes. It was part of an extensive western regional research project on the effect of food choices upon the physiological status of selected population groups, which is supported jointly by the funds allotted to the western agricultural experiment stations by Congress under the various agricultural research acts. The California phase of this research was undertaken with cooperation from the California State Department of Public Health, the U. S. Public Health Service, the Nutrition Research Branch of the U. S. Department of Agriculture, and the San Mateo Department of Public Health and Welfare. Beginning in 1948 the nutritional status of 577 aging persons living in San

Mateo County has been studied. In 1952 more than 300 of these people were re-examined in cooperation with the California State Department of Public Health and in 1955 that department made a limited re-examination of many of the subjects. Thus we hope to obtain a longitudinal view of the problem.

This is a brief report of the findings of the first and most thorough examination of these 280 men and 297 women. There were some 50 men all over 60 years of age living in the county home at Crystal Springs who were included and who constituted a rather special group. All the others were living in their own homes. About 75 percent of the latter were economically in the comfortable, but not wealthy, middle class; 6 percent were in the higher brackets; and about 19 percent were on relief and old age assistance rolls.

Seven day diet records were kept for each subject under the supervision of nutritionists, complete physical examinations were made by a U. S. Public Health Service physician and two nurses, laboratory analyses were obtained on blood and urine, and X-rays were taken of chest and bones.

RESULTS

The diet records indicated that the men living in their own homes ate from 15 to 34 percent (mean 27) more calories and protein and 0 to 50 percent (mean 25) more iron per kg. body weight than the women in the same age groups. The protein calories

were 14 percent of the total in both sexes and the iron intake 6.0 and 6.1 mg. per 1,000 calories. The qualitative nature of the diets was apparently the same. A trend toward decrease with age in intake of these nutrients was evident.

Hemoglobin

The hemoglobin levels and the volume of packed cells of the men living in their own homes were higher than those of the women, but in the groups 75 years of age and older the values declined in both men and women and the difference became significant. The mean hemoglobin values were 1 to 2 gm. percent lower than those usually reported for young adults, but the discrepancy was greater in men than in women. The volume of packed cells was equal to that of young adults. A summary of these and the other analyses is given in Table 1.

The majority of the higher intakes of both protein and iron were found in the groups with the higher levels of hemoglobin, and the lowest intakes in those with the lowest hemoglobin values. The positive correlation between dietary protein and hemoglobin was +0.12 and between iron and hemoglobin +0.13, both significant at the 1 percent level.

The men in the county home exhibited hemoglobin concentrations similar to those of the men living in their own homes but the volume of packed cells was somewhat lower. The protein intake of these men was

*The full reports of the biochemical studies by H. L. Gillum, A. F. Morgan, R. I. Williams, D. W. Jerome, M. Mural, and F. Saller were published in the *Journal of Nutrition*, Vol. 55, pp. 265-304, 431-468, 655-685, Feb., March, April, 1955.

TABLE I
MEAN VALUES FOR BLOOD CONSTITUENTS OF 577 MEN AND WOMEN
OVER 50 YEARS OF AGE

Blood constituent	Normal for young adults		San Mateo subjects over 50 years		Positive correlation with dietary factors
	Men	Women	Men	Women	
Hemoglobin, gm %-----	16.0	14.0	14.5 ±0.3	13.4 ±0.3	Protein and iron
Volume of packed blood cells, %-----	47.0	44.8	47.1 ±0.7	44.6 ±0.5	Same as hemoglobin
Sedimentation rates, %-----	0 to 6.5	0 to 15	12.6 ±1.5	20.8 ±1.5	
Sugar, mg %-----	86	86	103.1 ±4.6	100.9 ±4.6	Fat (in women)
Ascorbic acid, mg %-----	0.7 to 1.5	0.7 to 1.5	0.83 ±0.08	1.07 ±0.08	Ascorbic acid
Cholesterol-----	----	----	241 ±8	270 ±8	Fat and cholesterol
Vitamin A, mcg %-----	35	35	56 ±3	54 ±3	Vitamin A and carotene
Carotene, mcg %-----	92 to 177	92 to 177	118 ±9	120 ±10	Carotene
Serum protein, gm %-----	7.2	7.2	6.47 ±.06	6.44 ±.05	
Nonprotein nitrogen, mg %-----	25	25	38 ±1.4	34 ±1.2	Protein (in men)
Uric acid ¹ mg %-----	2.53 ±.13	2.33 ±.08	3.24 ±.19	2.98 ±.18	Protein (in men)
Creatinine ¹ mg %-----	1.27 ±.10	1.18 ±.07	1.53 ±.11	1.50 ±.08	

¹ Laboratory comparison with a group of 9 men and 14 women, 18 to 40 years of age.

of the same order as that of women but their iron intake was equal to that of the other men. This may point to greater importance of dietary iron than protein in regard to hemoglobin production or to a sex difference in this function. Although these women had intakes of protein and iron in proportion to total calories comparable to the men and were in all but one case past the menopause, they exhibited low hemoglobin levels in comparison with men of the same ages and general circumstances. At every level of protein and iron intake the percentage of men supporting a circulating level of 14 gms. percentage hemoglobin or more was about twice that of the women. There is a possibility that the male sex hormone may influence blood production significantly at least up to 75 years of age.

Blood Sugar

The overall mean of *blood sugar* levels was 101 mg. per 100 ml. blood,

higher than the means usually quoted for young adults. High blood sugar levels together with glycosuria were found in only 10 cases, but separately these conditions occurred in 2.1 to 5.6 percent.

The men in the county home over 65 years of age had significantly lower blood sugar levels, mean 85 mg. per 100 ml. blood, than men of the same age living in their own homes. There were six hyperglycemic and three diabetic cases also in this group.

A moderate positive correlation between fat intake and blood sugar level was found in the women but not in the men.

Ascorbic Acid

The women at all ages had higher serum *ascorbic acid* levels than the men, means 1.07 and 0.83 mg. percent respectively. In both sexes a maximum was noted in the age group 60 to 64 years. The total daily intakes of the men, however, were greater at

all ages than for the women and in proportion to body weight were also slightly higher.

The 44 men in the county home had only 0.27 mg. percent serum ascorbic acid and 40 mg. total daily intake or 0.62 mg. per kg. body weight.

A direct correlation, $r = +0.46$, was found between the serum levels and intakes of the whole group. Ninety-one percent of the men in the county home, 40 percent of those on relief and old age pensions, 21 percent of those with the middle incomes and none of those with the high incomes had serum levels less than 0.5 mg. percent. Thus some relationship between economic levels and serum ascorbic acid and intakes was demonstrated.

The conclusion is that the ascorbic acid requirement of men beyond 50 years of age may be significantly greater than that of women.

Thirty-nine percent of the people examined were without teeth, 17 percent had gingivitis in some degree and 44 percent had teeth and no gum pathology. Of the group with teeth and healthy gums, 54 percent were in the higher serum ascorbic acid levels, over 0.7 mg. percent. However, 34 percent of this higher serum level group were without teeth and 17 percent in this group had gingivitis. Twenty-four percent of those without teeth and of those with gingivitis had serum ascorbic acid below 0.3 mg. percent. Only 9 percent of those with healthy mouths had serum ascorbic acid below the 0.3 mg. percent level.

Cholesterol

The serum *cholesterol* levels were found to vary from 106 to 720 mg. per 100 ml. blood, the means for the men being 241 ± 8 and for the women, 270 ± 8 . The mean level of the 43 men over 60 years of age living in the county home was 209 ± 12 .

The women had significantly higher levels than the men between the ages of 60 and 80 years. In both sexes a sharp drop in the levels occurred at 75 or 80 years. There was downward trend in the levels of the men with each decade but a sustained high level was shown by the women in the groups from 60 to 75 years of age after a sharp drop in the 54 to 59 year group. This drop may be due to a post-menopausal spurt in steroid hormone production.

A positive correlation of the order of 0.12 was found between dietary cholesterol and serum cholesterol levels in both men and women and a similar correlation, 0.15 in men, 0.09 in women, between fat intake and serum cholesterol levels. When intake of fat of animal origin only was considered the correlation was lower.

Extreme under or over weight, 20 percent or more, in men but not in women, was found to be associated with low and high serum cholesterol levels respectively as well as with low and high intakes of fat and cholesterol. No such relationship was seen in the groups with lesser deviations from the normal weight.

No relationship between blood pressure and serum cholesterol levels was found in any of the groups.

It is clear that standards of hypercholesterolemia must be different for men and women and that dietary fat and cholesterol are associated positively with the serum cholesterol levels, and thus possibly with the development of atherosclerosis.

Vitamin A and Carotene

A small decline in both *vitamin A* and *carotene serum levels* occurred with age in both men and women. No significant sex differences were found.

The dietary intakes were calculated separately for preformed vitamin A, found in foods of animal origin, and for carotene, found in foods of vegetable origin, and the probably true vitamin A equivalent determined. This was found to be 2889 mcg. per day for the men living in their own homes, 2266 for the women and 1572 for the men in the county home. This amounted to 40, 35, and 25 mcg. per kg. body weight. Forty percent of the intake of the men living in their own homes was from carotene, 43 percent of that of the women and 29 percent of that of the men in the county home. About 11 percent of the men and 20 percent of the women took vitamin A supplements more or less regularly.

A slight positive correlation between total vitamin A intake and serum vitamin A level was established for both men and women. The correlation between serum carotene and carotene intake was much more pronounced, $r^2 = 0.37$.

Thickening of the bulbar conjunctiva was noted in 94.1 percent of

the subjects, but this was not more marked in those with low than in those with high serum levels of vitamin A. The same was true of the other changes in the conjunctiva and skin. There was more relationship to age in the distribution of these changes than to vitamin A levels or intakes.

Gall bladder disease, thyroid enlargement or functional derangement, and habitual use of mineral oil were found to have variable and small effects upon serum levels of vitamin A and carotene.

Serum Protein

The total *serum protein levels* were determined in nearly all the subjects and the *nonprotein nitrogen, uric acid and creatinine levels* in the blood of about half.

The average serum protein level was 6.47 ± 0.06 gm. percent in the men and 6.44 ± 0.05 in the women. These levels are 10 to 15 percent lower than those usually quoted for young adults. No correlation with protein intake was found nor was there any age or sex difference, but there was some positive relationship to hemoglobin levels.

Nonprotein Nitrogen

The blood nonprotein nitrogen was greater in the men than in the women, but after 70 years this difference was not significant. In the men, but not in the women, the nonprotein nitrogen levels were positively correlated with protein intake. The mean levels were about 40 percent higher than those usually found in young adults. The blood uric acid levels were also higher in men than in women, but after 70 years the differences were less marked and the levels decreased. The mean values were 28 percent larger than those found by the same method in a group of young men and women. There was no correlation with the fat intake but a small positive correlation with protein intake in the men but not in the women.

The blood creatinine levels were not affected by sex or age. No correlation with protein intake could be detected. The levels are 20 to 30 percent higher than those usually quoted for young adults.

The data suggest greater response of the nitrogen metabolism to dietary protein in older men than in women

or gradual failure of kidney function which is more marked in the men.

SUMMARY OF BLOOD FINDINGS

In final summary it may be said that hemoglobin levels in the blood but not total serum protein were directly affected by both the protein and the iron of the diet. Nonprotein nitrogen and uric acid levels were directly affected by dietary protein in men but not in women, and this may be due to lowering of kidney clearance. Serum ascorbic acid levels and the health of teeth and gums appeared to be positively correlated with the ascorbic acid of the diet, and men seemed to require greater ascorbic acid intake than women to maintain equal serum levels. The blood sugar levels of women were raised when fat intake was high. Serum cholesterol levels were generally significantly higher in women than in men and in both were correlated positively with dietary cholesterol and fat. Serum vitamin A and carotene levels were also positively correlated with intakes, more obviously in the case of carotene. No physical signs of vitamin A deficiency could be aligned with lack of intake or low serum levels.

The group of men in the county home in nearly every respect exhibited physical signs of poorer nutritional status than did the men living in their own homes. Their blood cell volumes and blood sugar levels were lower except in the diabetics. Their serum cholesterol, ascorbic acid, vitamin A and carotene levels were all significantly lower than in the other men. Their hemoglobin levels however were equal to those of the others as was their total serum protein. All of these data as well as other physical measurements such as body weight, pointed to stressful lives and poorly chosen or inadequate diets.

The direct effect upon physical state of kind and quality of food intake was again demonstrated in this study of 577 aging persons. Both excesses and inadequacies had left their marks.

COMPARISON OF FOOD INTAKES OF SAN MATEO SUBJECTS WITH RECOMMENDED ALLOWANCES

The dietary allowances recommended by the Food and Nutrition Board of the National Research

Council in 1943¹ have been revised in 1945², 1948³, and last in 1953⁴. In the last revision for the first time a new classification of adults by age was introduced. Figures are presented for men and women 25, 45, and 65 years old. The only nutrients for which differences due to age are suggested are calories, thiamine (based on calories) and niacin (based on thiamine). A comparison of the amounts of these and the other nutrients consumed by the 280 men and 297 women in the San Mateo study seems worthwhile.

The calorie allowance for 65 year old people was lowered in the 1953 N.R.C. table by 300 calories or about 10 and 14 percent respectively for men and women below that suggested for 45 year old people. This was based on the lowering of basal metabolism with age as well as on the assumed decreased activity. The thiamine allowance was a generous estimate of the probable maximum requirement based on the total calories, 0.5 mg. per 100 calories and is therefore also lowered in about the same amount as the calories, 13 and 9 percent for older men and women respectively. In lieu of a more specific basis the allowance for niacin was maintained at 10 times the thiamine

amount and was thus also lowered somewhat for adults of the 65 year group.

These allowances are compared in Tables 2 and 3 with the mean amounts actually consumed by the San Mateo subjects. It will be noted that these men and women were of nearly the same average heights but on the average 15 and 22 pounds respectively heavier than the reference man and woman of the N.R.C. table. Their calorie intakes were less by 10 and 6 percent. These are nevertheless surprisingly close totals, particularly when possibly 5 percent downward revision might be applied to the San Mateo requirements due to climate.

An upward adjustment for greater body weight would increase the discrepancy since the allowances based on the actual weight of the San Mateo group are 2820 and 2132 calories for men and women respectively. These are about 400 calories in excess of the amounts reported as eaten. Apparently the excess weight of the subjects represents the accumulation of earlier years which was in process of liquidation when the study was made. Up to age 70 in women and 60 in men the actual calorie intakes were nearly the same as recommended but beyond these ages the intakes were reduced. At all ages the calories per kg. body weight were lower in both men and women than the amounts recommended (Table 2).

The mean thiamine intakes of both men and women, 1.2 and 0.9 mg., were slightly but probably not significantly less than the recommended allowances, 1.3 and 1.0 mg., and exactly equal to the needs if these are based on the actual calorie intakes. At 0.5 mg. thiamine per 1000 calories, the men needed 1.2 and the women 0.9 mg. (Table 3).

The mean niacin intakes of both men and women, 15 and 11 mg., were greater than the recommended allowances, 13 and 10 mg., and greater than the 10 to 1 ratio with thiamine used in the N.R.C. allowances (Table 3).

These differences probably reflect the relatively high meat, eggs and milk and relatively low cereal intakes of the San Mateo group.

The intakes of the nutrients except the B vitamins listed in the table of allowances are shown in Table 2. Total protein intake of both men and women exceeded the amounts recommended and in gms. per kg. as well in the case of the men, 1.1 compared with 1.0, but is slightly low in the intake of the women, 0.9 compared with 1.0. The difference however is not significant. In both calcium and iron intakes the totals consumed by the men are greater than the recommended amounts but those of the women are slightly and perhaps significantly low. The vitamin A intakes of both men and women exceeded considerably the recommended allow-

¹ National Research Council. Reprint and Circular Series, No. 115, 1943.
² National Research Council. Reprint and Circular Series, No. 122, 1945.
³ National Research Council. Reprint and Circular Series, No. 129, 1949.
⁴ National Research Council. Bulletin No. 302, 1953.

TABLE 2
COMPARISON OF DIETARY INTAKES OF 577 SUPPOSEDLY HEALTHY MEN AND WOMEN OVER 50 YEARS OF AGE WITH THE N. R. C. 1953 RECOMMENDED DAILY ALLOWANCES

	Age	Weight		Height		Calories		Protein		Calcium	Iron	Vit. A		Ascorbic Acid			
		years	kg	lbs	cm	inches	total	per kg	total gm	per kg gm			I.U.		mg total	per kg	
													total	per kg			
Men																	
N.R.C. ¹	65	65	143	170	67	2,600	40	65	1.0	0.8	12	5,000	77	75	1.15		
S.M. ²	50-59	74	163	172	68	2,618	35	94	1.3	0.9	16	11,300	153	97	1.31		
	60-69	72	158	170	67	2,437	33	85	1.2	0.9	14	10,140	141	112	1.55		
	70+	70	154	168	66	2,165	31	76	1.1	0.9	14	10,400	149	96	1.37		
Women																	
N.R.C. ¹	65	55	121	157	62	1,800	33	55	1.0	0.8	12	5,000	91	70	1.27		
S.M. ²	50-59	76	147	161	63	1,780	26	61	0.9	0.6	11	7,900	118	87	1.30		
	60-69	65	143	161	63	1,800	27	63	1.0	0.7	11	9,350	142	90	1.38		
	70+	63	139	157	62	1,586	25	58	0.9	0.6	10	7,500	119	82	1.30		

¹ National Research Council, Publ. 302, 1953.

² San Mateo group of 577 men and women studied in 1948-49.

TABLE 3

COMPARISON OF B VITAMIN INTAKES OF MEN AND WOMEN OVER 50 YEARS OF AGE WITH THE N. R. C. 1953 RECOMMENDED DAILY ALLOWANCES

Age years	Thiamine		Riboflavin		Niacin total	
	total	per 1000 cal.	total	per kg		
	mg	mg	mg	mg		
Men N.R.C.	65.....	1.3	0.50	1.6	0.025	13
S.M.	50-59.....	1.2	0.46	2.0	0.027	16
	60-69.....	1.2	0.49	2.0	0.028	15
	70+.....	1.2	0.55	2.1	0.030	14
Women N.R.C.	65.....	1.0	0.55	1.4	0.025	10
S.M.	50-59.....	0.9	0.50	1.4	0.021	11
	60-69.....	0.9	0.50	1.6	0.025	12
	70+.....	0.9	0.56	1.3	0.021	10

ances as did the ascorbic acid intakes. Riboflavin intake (Table 3) of the men both total and per kg. was greater than the recommended amount and that of the women was equal in total amount but slightly lower per kg. than the recommended allowance, .023 mg. per kg. compared with 0.25.

The significance of these comparisons can be assessed more reasonably in the light of the biochemical findings and the physical condition of the people examined.

The protein status of the subjects was apparently satisfactory although the serum protein levels, 6.47 ± 0.06 and 6.44 ± 0.05 gm. percent, were somewhat lower than is usually reported for young adults. The mean hemoglobin levels, 14.5 ± 0.3 and 13.4 ± 0.3 gm. percent, were also 1 to 2 gm. percent lower than those of young adults. There is no clear evidence however that these differences stem from deficiency in protein intake rather than from the aging process. The levels of nonprotein nitrogenous constituents of the blood were greater than those in young adults, a condition ascribable perhaps to failure of kidney function. If this latter assumption is correct any large increase in protein intake might not be advantageous.

If the iron sufficiency may be judged in terms of the hemoglobin concentration both men and women are similarly deficient but the actual iron intake of the men exceeded significantly the recommended amount.

Vitamin A and carotene levels in the blood of these subjects were relatively high compared with those reported in most of the studies of populations of all ages. Physical signs supposedly symptomatic of deficiency were seen in some cases but these were not correlated with either serum levels or dietary intakes of vitamin A and carotene.

Mean serum ascorbic acid levels were high in these people as compared with those reported elsewhere. The serum levels, dietary intakes and health of the teeth and gums appeared to be correlated positively.

No direct measures of the status as to calcium, thiamine, riboflavin and niacin were obtained.

In summary the following tentative conclusions may be suggested.

1. These aging persons, particularly those over 70 years of age, tend to decrease their calorie intakes by more than the 300 calories suggested in the recommended allowances and this in spite of body weights 10 and 18 percent greater than those of the reference man and woman. Thiamine but not niacin intakes were similarly reduced along with the calories.

2. The protein intakes of well fed aging men and women appear to be generally higher than those recommended but their serum protein and hemoglobin levels nevertheless were lower than those of young adults. High levels of nonprotein nitrogenous blood constituents point to possible deterioration of kidney function and

so to a limitation in the protein intake. The protein intake in terms of body weight appeared to remain very close to 1.0 gm. per kg.

3. Iron intake of the men was higher but that of the women was 20 percent lower than the recommended amount. Iron intakes above 8 mg. per day were associated in 50 to 70 percent of the men with hemoglobin levels over 14 gm. percent, but intakes from 8 to more than 16 mg. of iron per day in women produced this level of hemoglobin in only 23 to 37 percent.

The 47 men in the county home also had more than the recommended iron intake and their hemoglobin levels were equal to those of the other men in spite of lower protein intake. This might point to the lowered iron intake of the women as in part responsible for their lower hemoglobin levels since their protein intake was about the same as that of the men in the county home. A sex hormone regulation may also be involved.

4. Calcium intake was adequate in the men and somewhat low in the women compared with the recommended allowances.

5. Vitamin A and carotene in large excess of the recommended amounts appear to be easily incorporated in the diets of aging persons. Supplements of vitamin A were taken by some of the subjects and these were included in the comparison. In order to secure a level of 50 to 65 micrograms vitamin A per 100 ml. of blood in 50 percent of the men more than 8,000 I. U. daily intake of total vitamin A and carotene was required. In women 42 percent attained these levels on this intake.

6. Ascorbic acid intake is closely correlated with the serum level. To obtain a level above 1.1 mg. percent in 50 percent of the men required a daily intake above 110 mg., but in the women only 90 mg. was required. The allowances should probably be raised to these amounts.

THE PERCENTAGE OF INDIVIDUALS WITH LESS THAN TWO-THIRDS THE RECOMMENDED ALLOWANCES

Despite the adequacy of mean intakes of nutrients in this group there were of course some individuals whose intakes were lower than the recommended N.R.C. allowances. The percentage of men and women having

TABLE 4

PERCENTAGE OF MEN AND WOMEN OVER 50 YEARS OLD (SAN MATEO COUNTY) WHO HAD LESS THAN TWO-THIRDS OF THE RECOMMENDED ALLOWANCE OF VARIOUS NUTRIENTS N. R. C. PUBL. 302, 1953)

Age years	Total No.		Nutrient	Intake less than $\frac{2}{3}$ recommended					
				Percent men			Percent women		
	men	women		50-59 yrs.	60-69 yrs.	70+ yrs.	50-59 yrs.	60-69 yrs.	70+ yrs.
50-59	79	95	Calories.....	9	6	6	10	5	9
60-69	72	106	Ascorbic acid.....	19	21	15	23	12	24
70+	64	73	Calcium.....	14	14	14	46	34	24
All	215	274	Thiamine.....	13	10	6	25	10	13
			Riboflavin.....	2	7	5	17	13	11
			Niacin.....	6	10	8	8	3	8
			Vitamin A.....	4	6	8	18	9	14
			Iron.....	1	0	3	13	6	25
			Protein.....	0	3	1.5	3	2	4

less than two-thirds of the recommended quantities is shown in Table 4.

From 5 to 10 percent of the group had less than two-thirds the recommended amount of calories. In view of varying sizes and activities this deficit cannot be regarded as valid. Moreover any suggested deficiencies in either thiamine or niacin, the allowances for which are based on calorie intake, if reasonably close to that of the calorie intake, may likewise be invalid. Only in women, 50-59, was there a significantly low thiamine intake, 25 percent of these women had less than two-thirds of the recommended allowance and only 10 percent had the same amount of calorie deficit. This age group of women had the largest proportion of low intakes of the nutrients. Niacin intake appeared to follow that of calories.

Riboflavin need is partly dependent on body size and partly on calorie intake. There was an insignificant number of men with shortages of riboflavin not accounted for by lowered calorie intake, but 11 to 17 percent of the women had such shortage, a larger proportion than the calorie deficit warranted.

A calcium intake shortage was seen in 14 percent of the men and about 36 percent of the women. This is the largest number of cases of shortage shown for any nutrient. The conclu-

sion may either be that the recommended allowance for calcium is larger than requisite or that a considerable number of older women in particular choose a calcium-poor diet.

The iron intake was adequate in practically all the men's records but 25 percent of the women over 70 had less than two-thirds of the recommended amount.

Ascorbic acid appears to be the next most frequent shortage in the diets. About 20 percent of the men and 18 percent of the women took less than two-thirds the recommended amounts. Only about 6 percent of the men and 13 percent of the women were similarly low in vitamin A intake. About 13 percent of the women were also low in iron. There were very few of either men or women low in protein. All of these deficiencies were well distributed among the age groups.

Thus, aside from calorie and calorie-tied vitamin deficits, ascorbic acid and calcium are the nutrients in which the diets of both men and women are most likely to be low, the former in about one-fifth of all the diets, the latter in one-seventh of the diets of the men and more than one-third of those of the women. In addition 13 percent of the women were similarly low in both vitamin A and iron.

The foods which supply the missing items are numerous and various—milk, fruits, green and yellow vegetables being most prominent. Whole milk would add effectively to the calcium and vitamin A intakes but not to those of ascorbic acid and iron.

Rabies Endemic Areas Declared by Department

On October 10th, 26 California counties were officially declared endemic for animal rabies by the State Department of Public Health. The declaration was made on the basis of the rapid increase in reported cases of rabies in animals this year, with 291 cases, 154 in dogs and 126 in wild animals, already recorded since January 1st. This compares with a total of 83 cases, 33 in dogs and 43 in wild animals, reported in 19 counties for all of 1954.

The department declares an endemic situation when an animal reservoir of infection exists which poses a threat to humans as well as to wild and domestic animals. Chief concern is the potential transmission of rabies from infected wildlife to dogs, since the risk of human rabies exposure and infection and the number of persons requiring protective treatment will be greatly increased if dogs become more seriously involved.

Rabies currently is endemic in the Counties of Alameda, Amador, Butte, Colusa, El Dorado, Fresno, Humboldt, Lake, Los Angeles, Marin, Mendocino, Merced, Monterey, Napa, Sacramento, San Benito, San Joaquin, Shasta, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Ventura and Yolo. Existing legislation provides for the addition or deletion of counties from the endemic list as conditions warrant.

Local health authorities in the 26 counties will determine, in consultation with the State Health Department, the nature of control actions which are required, including the boundaries for quarantine of dogs. It is probable that in the majority of cases quarantine actions will be countywide. But whatever quarantine action is taken must meet the requirements of the California Health and Safety Code, in addition to whatever local ordinances are desired.

According to state law and regulations adopted by the State Board of Public Health, dogs under quarantine must be kept under restraint. However, at the discretion of the local health officer, dogs may be released from restraint 30 days after they have been vaccinated against rabies. Vaccination is not compulsory; the owners of dogs in quarantine areas have the choice of either keeping their dogs under restraint or having them vaccinated.

Because requirements may vary from county to county, the department has suggested that dog owners contact their local health officer for additional information concerning quarantine, vaccination, tagging or licensing.

For the same reason, hunters with dogs were advised by the department to check local rabies control regulations with the health officers having jurisdiction in the areas where they plan to hunt. Because of the high incidence of rabies in wild life hunters were further advised that if bitten by a wild animal they should bag the biting animal if possible, contact a private physician or the local health officer immediately, and have the animal delivered to the local health department for laboratory tests for rabies.

Of the 291 cases of rabies thus far this year, 126 were in wild animals and 165 in domestic animals. Of the wild animal cases, 104 were in skunks, 17 in foxes, three in bobcats, one in a raccoon and one in a bat. Of the domestic animal cases, 154 were in dogs, nine in cows, one in a cat and one in a goat.

Madera Man Bitten by Rabid Bat

A Madera man was recently bitten by a bat, later proved to be rabid, and is now undergoing antirabies treatment. This is the third case of rabies in bats to be found in California.

The man now being treated was pruning a tree in his yard when he noticed a bat hanging from it. It hissed at him and was belligerent, according to his account. Thinking it would be a good specimen for his son's high school science class, he reached for it. The bat bit him and hung on until pried off.

It was taken to the science teacher at Madera High School and was found dead the next morning. It was then sent for examination to the Division of Laboratories of the State Department of Public Health. A direct smear examination was inconclusive, but pooled brain and salivary tissues inoculated into mice produced symptoms of rabies in the mice 10 days later, and Negri bodies were found in their brains. This confirmed the diagnosis of rabies. Later the rabies virus was isolated from both the brain and salivary tissues in separate tests.

The carcass of the bat was destroyed before identification could be made, but from the information obtained by investigators from the State Department of Public Health it is concluded that it was probably a Mexican freetail (*Tadarida mexicana*). This conclusion is supported by the fact that the bat appeared in the residential district of Madera, and freetail bats tend to predominate in urban areas. The only other reasonable possibilities seem to be the big brown bat (*Eptesicus fuscus*), the Yuma myotis (*Myotis yumanensis*), or the California myotis (*Myotis californicus*). A brief search for bats was made in the vicinity, but none was obtained.

Previous to this case, only two bats had been found to be infected with rabies in California. The first one was a Mexican freetail found in Sonoma County, July 20, 1954. This bat was collected in a survey of bats obtained in a five-county area in Northern California where there was a high incidence of wild life rabies over a four-year period. Pooled brain and salivary tissues were inoculated into mice and the virus of rabies was isolated.

The second bat was found floating in a fish pond in a park in Kern County. Since the brain was decomposed, only the salivary glands were taken for mouse inoculation tests. From this specimen, rabies virus was isolated by Dr. Harold N. Johnson, Rockefeller Foundation, in the course of his encephalitis studies in Kern County. The bat was identified as California myotis (*Myotis californicus*).

It is interesting that this bat was found in an area in the northern part

of Kern County only 8 to 10 miles from the location in Tulare County where late in 1954 a rabid spotted skunk bit a woman who subsequently developed symptoms of rabies and died three days after the symptoms appeared. (See *California's Health*, January 1, 1955.)

Public Health Positions

Butte County

Public Health Nurses: Salary range, \$315-\$391. Two positions open. Generalized with school program. Upper Sacramento Valley in foothills of Sierra Mountains. Liberal personnel policies. 37½-hour week. No uniforms. Optional county car or 8 cents a mile. Write G. L. Faber, M.D., M.P.H., Director, Butte County Health Department, P. O. Box 1100, Chico.

Marin County

Sanitarians: Salary range \$341-\$426. Starting salary depends upon qualifications. Two positions open. Certificate as Registered Sanitarian and a driver's license required. Apply to Carolyn B. Albrecht, M.D., Marin County Health Officer, 920 Grand Ave., San Rafael.

Napa County

Public Health Nurse: Salary range, \$341-\$415. Starting step depends on qualifications. Car necessary; mileage allowed. Contact Napa County Health Department, P. O. Box 749, Napa.

Sacramento County

Registered Sanitarians: Salary range, \$355-\$433. Mileage in addition to salary. Vacancies in rural area.

Public Health Nurses: Salary range, \$338-\$412. Mileage in addition to salary. Two positions in rural area. Vacation, sick leave and retirement.

Further information about the above positions may be obtained from I. O. Church, M.D., Sacramento County Director of Public Health, 1121 Terminal Way, Sacramento, or from the County Personnel Department, Courthouse, Sacramento.

San Bernardino County

The following positions are open in the San Bernardino County Health Department. Salaries and minimum requirements are briefly given below. For applications and further information write Department of Civil Service and Personnel, 230 Third St., San Bernardino.

Assistant Director of Public Health: Salary range, \$713-\$886. Valid license to practice medicine in California required.

Medical Social Worker-Consultant: Salary range, \$360-\$438. Completion of a two-year post graduate course in an accredited school of social work and one year full-time paid medical social work experience required.

Public Health Nurse: Salary range, \$360-\$397. Valid California Public Health Nurse Certificate required. For another position in the desert, salary begins at step \$378.

Assistant Public Health Nurse: Salary range, \$296-\$327. Valid California Public

Health Nurse Certificate required. Another position in the desert starts at step \$311.

Sanitarian: Salary range, \$343-\$417. Must have a valid California certificate as a registered sanitarian and a driver's license. Another position in the desert starts at step \$378.

Stanislaus County

Public Health Nurse: Salary range, \$333-\$400. Must have California certificate or registration or be eligible for it. Car provided.

Sanitarian: Salary range, \$333-\$400. Must have California certificate or registration or be eligible for it. Car provided.

Public Health Laboratory Bacteriologist: Salary starts at \$333. California certificate required.

For further information about any of the above positions, write Irena A. Heindl, M.D., County Health Officer, P. O. Box 1607, Modesto.

Review of Reported Communicable Diseases Morbidity by Month of Report September, 1955

Diseases With Incidence Exceeding the Five-year Median

Diseases	Sept. 1955	Sept. 1954	Sept. 1953	Five-year Median
Amebiasis	77	78	52	43
*Coccidioidomycosis	18	6	5	5
Food poisoning	212	54	43	48
Hepatitis, infectious, including serum hepatitis	134	190	167	108
Measles	443	521	534	265
Mumps	1,181	928	1,040	854
Rabies, animal	35	4	20	5
Salmonella infections	70	65	75	65
Shigella infections	115	106	148	86

Diseases Below the Five-year Median

Diseases	Sept. 1955	Sept. 1954	Sept. 1953	Five-year Median
Brucellosis	2	5	9	9
Encephalitis (Western equine)	1	13	8	13
Encephalitis (St. Louis)	2	54	10	12
Encephalitis (type undetermined)	9	61	20	28
Malaria	6	8	17	8
Meningitis	11	21	31	21
Pertussis	262	677	122	362
Poliomyelitis (total)	349	1,101	848	730
Poliomyelitis (paralytic)	168	616	453	451
Streptococcal infections, resp., incl. scarlet fever	140	224	216	199
Tetanus	5	5	7	6
Typhoid fever	8	19	13	13

Venereal Diseases

Diseases	Sept. 1955	Sept. 1954	Sept. 1953	Five-year Median
Syphilis	457	662	605	623
Gonococcal infections	1,206	1,577	1,526	1,466
Chancroid	15	16	14	1
Granuloma inguinale	—	1	1	1
Lymphogranuloma venereum	2	5	9	1

¹ Median not calculated.

* Prior to July 1st, only disseminated form was reportable.

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